

What is claimed is:

1. A three-dimensional video game apparatus that perspective-transforms a virtual three-dimensional space where multiple characters exist onto a virtual screen based upon a virtual camera having a viewpoint position moved in response to positions of the multiple characters, comprising:
  - a character mover that moves at least one of the characters in the virtual three-dimensional space;
  - a central position calculator that calculates a central position of the characters in the virtual three-dimensional space;
  - 10 a temporary point setting device that sets multiple temporary points in the virtual three-dimensional space with reference to the calculated central position;
  - a temporary viewpoint position setting section that sets a temporary viewpoint position on each straight line, connecting each of the temporary points to the central position, where all of the characters can be projected on the virtual screen with a predetermined visual angle;
  - 15 a distance calculator that calculates a distance between each of the set temporary viewpoint positions and the calculated central position;
  - a viewpoint position evaluator that evaluates each temporary viewpoint position based on each calculated distance;
  - 20 a viewpoint position selector that selects a position where the viewpoint of the virtual camera should be moved among the temporary viewpoint positions based on the evaluation result;
  - a viewpoint position mover that moves the viewpoint position of the virtual camera to the selected position; and
  - 25 a perspective transformer that perspective-transforms the three-dimensional space onto the virtual screen based upon the virtual camera where the viewpoint position is moved.

2. The three-dimensional video game apparatus according to claim 1, further comprising an angle calculator that calculates an angle formed by a straight line connecting a current viewpoint position of the virtual camera to the calculated central position and each straight line connecting each of the temporary viewpoint positions to the central position, wherein said viewpoint position evaluator further evaluates each temporary viewpoint position based on the calculated angle.

3. The three-dimensional video game apparatus according to claim 1, further comprising an overlap degree calculator that calculates an overlap degree of the characters when the viewpoint of the virtual camera is set to each of the temporary viewpoint positions and perspective transformation is executed, wherein said viewpoint position evaluator further evaluates each temporary viewpoint position based on the calculated overlap degree.

4. The three-dimensional video game apparatus according to claim 3, wherein multiple reference points are assigned to the multiple characters, and said overlap degree calculator calculates the overlap degree of the characters according to an overlapping area of polygons drawn by connecting the reference points projected on the virtual screen in connection with each of the multiple characters.

5. The three-dimensional video game apparatus according to claim 1, further comprising a height difference determining device that determines a height difference between the characters, wherein said viewpoint position evaluator further evaluates each temporary viewpoint position based on the determination result of the height difference.

6. The three-dimensional video game apparatus according to claim 5, wherein said height difference determining device includes a judging device that judges whether the height difference between the characters is more than a predetermined value, and said viewpoint position evaluator evaluates each temporary viewpoint position such that the higher the temporary viewpoint position is placed, the more highly the temporary viewpoint position is rated when the height difference between the characters is not

more than the predetermined value, the lower the temporary viewpoint position is placed, the more highly the temporary viewpoint position is rated when the height difference between the characters is more than the predetermined value.

7. The three-dimensional video game apparatus according to claim 1, wherein  
5 said viewpoint position selector selects multiple viewpoint positions among the temporary viewpoint positions according to the evaluation result, and said viewpoint position mover switches the viewpoint of the virtual camera to the selected viewpoint positions sequentially.

8. The three-dimensional video game apparatus according to claim 7, wherein  
10 said viewpoint position mover includes a controller that controls switching of the viewpoint position of the virtual camera every time a predetermined time period passes.

9. The three-dimensional video game apparatus according to claim 7, wherein  
said viewpoint position mover includes a controller that controls switching of the viewpoint position of the virtual camera according to the evaluation result of the  
15 selected multiple positions.

10. The three-dimensional video game apparatus according to claim 7, further comprising a viewpoint switching director that directs switching of the viewpoint position of the virtual camera by a player's operation, wherein said viewpoint position mover includes a controller that controls switching of the viewpoint position of the  
20 virtual camera every time switching is directed from said viewpoint switching director.

11. The three-dimensional video game apparatus according to claim 1, wherein a range limit where the viewpoint position of the virtual camera can be moved is fixed in the virtual three-dimensional space, and the three-dimensional video game apparatus further includes a range limit judging device that judges whether the selected viewpoint  
25 position of the virtual camera is within the range limit, a viewpoint position adjustor that moves the viewpoint position of the virtual camera to a central position within the range limit when the selected viewpoint position of the virtual camera is not within the

range limit, and a visual angle adjustor that changes the visual angle of the virtual camera such that all of the characters are projected on the virtual screen.

12. The three-dimensional video game apparatus according to claim 1, further comprising a viewpoint moving director that directs movement of the viewpoint  
5 position of the virtual camera by a player's operation, wherein said viewpoint mover moves the viewpoint position of the virtual camera according to the direction of the movement.

13. The three-dimensional video game apparatus according to claim 12, wherein said viewpoint position mover moves the viewpoint position of the virtual camera  
10 regardless of whether the viewpoint position is the position selected from the temporary viewpoint positions.

14. The three-dimensional video game apparatus according to claim 1, further comprising a time counter that counts elapse of a fixed time interval, and a starter that starts said central position calculator, said temporary point setting device, said distance  
15 calculator, and said viewpoint position evaluator every time the fixed time interval elapses.

15. The three-dimensional video game apparatus according to claim 1, wherein the characters include multiple player characters that move in the virtual three-dimensional space by player's instructions, and said three-dimensional video  
20 game apparatus further comprises a player character switching device that sequentially switches a player character that can receive a player's instruction and a starter that starts said central position calculator, said temporary point setting device, said distance calculator, and said viewpoint position evaluator every time the player character that can receive the player's instruction is switched.

25 16. The three-dimensional video game apparatus according to claim 1, wherein said central position calculator assigns weight to each of the characters existing in the three-dimensional space to calculate the central position of the multiple characters.

17. The three-dimensional video game apparatus according to claim 1, further comprises a character selector that selects a character to be used to decide the viewpoint position of the virtual camera among the characters existing in the three-dimensional space according to the progress of the game.

5        18. A three-dimensional video game apparatus that perspective-transforms a virtual three-dimensional space where multiple characters exist onto a virtual screen based upon a virtual camera having a viewpoint position moved in response to positions of the multiple characters, comprising a memory that stores a game program, a processor that executes said game program, and a display device that displays a  
10        processing result of said processor, wherein the game program is stored in said memory and causes said processor to execute:

          moving at least one of the characters in the virtual three-dimensional space;

          calculating a central position of the characters in the virtual three-dimensional space;

15        setting multiple temporary points in the virtual three-dimensional space with reference to the calculated central position;

          setting a temporary viewpoint position on each straight line, connecting each of the temporary points to the central position, where all of the characters can be projected on the virtual screen with a predetermined visual angle;

20        calculating a distance between each of the set temporary viewpoint positions and the calculated central position;

          evaluating each temporary viewpoint position based on each calculated distance;

          selecting a position where the viewpoint of the virtual camera should be moved among the temporary viewpoint positions based on the evaluation result;

25        moving the viewpoint position of the virtual camera to the selected position; and

          perspective-transforming the three-dimensional space onto the virtual screen based upon the virtual camera where the viewpoint position is moved.

19. The three-dimensional video game apparatus according to claim 18, wherein the game program further calculates an angle formed by a straight line connecting a current viewpoint position of the virtual camera to the calculated central position and each straight line connecting each of the temporary viewpoint positions to the central position, and each temporary viewpoint position is further evaluated based on the  
5 calculated angle.

20. The three-dimensional video game apparatus according to claim 19, wherein the game program further calculates an overlap degree of the characters when the viewpoint of the virtual camera is set to each of the temporary viewpoint positions and perspective transformation is executed, and each temporary viewpoint position is further  
10 evaluated based on the calculated overlap degree.

21. The three-dimensional video game apparatus according to claim 18, wherein the game program further determines a height difference between the characters, and each temporary viewpoint position is further evaluated based on a determination result  
15 of the height difference.

22. A method for controlling a viewpoint position of a virtual camera based on positions of multiple characters existing in a virtual three-dimensional space in a three-dimensional video game that perspective-transforms the virtual three-dimensional space onto a virtual screen based upon the virtual camera, comprising:

20 moving at least one of the characters in the virtual three-dimensional space;

calculating a central position of the characters in the virtual three-dimensional space;

setting multiple temporary points in the virtual three-dimensional space with reference to the calculated central position;

25 setting a temporary viewpoint position on each straight line, connecting each of the temporary points to the central position, where all of the characters can be projected on the virtual screen with a predetermined visual angle;

calculating a distance between each of the set temporary viewpoint positions and the calculated central position;

evaluating each temporary viewpoint position based on each calculated distance;

selecting a position where the viewpoint of the virtual camera should be moved

5 among the temporary viewpoint positions based on the evaluation result;

moving the viewpoint position of the virtual camera to the selected position; and

perspective-transforming the three-dimensional space onto the virtual screen based upon the virtual camera where the viewpoint position is moved.

23. The method according to claim 22, wherein an angle formed by a straight  
10 line connecting a current viewpoint position of the virtual camera to the calculated central position and each straight line connecting each of the temporary viewpoint positions to the central position is further calculated, and each temporary viewpoint position is further evaluated based on the calculated angle.

24. The method according to claim 22, wherein an overlap degree of the  
15 characters is further calculated when the viewpoint of the virtual camera is set to each of the temporary viewpoint positions and perspective transformation is executed, and each temporary viewpoint position is further evaluated based on the calculated overlap degree.

25. The method according to claim 22, wherein a height difference between the  
20 characters is further determined, and each temporary viewpoint position is further evaluated based on a determination result of the height difference.

26. A computer-readable storage medium on which a game program for  
executing a video game that perspective-transforms a virtual three-dimensional space where multiple characters exist onto a virtual screen based upon a virtual camera having  
25 a viewpoint position moved in response to positions of the multiple characters, the game program causing a computer apparatus to execute:

moving at least one of the characters in the virtual three-dimensional space;

calculating a central position of the characters in the virtual three-dimensional space;

setting multiple temporary points in the virtual three-dimensional space with reference to the calculated central position;

5        setting a temporary viewpoint position on each straight line, connecting each of the temporary points to the central position, where all of the characters can be projected on the virtual screen with a predetermined visual angle;

calculating a distance between each of the set temporary viewpoint positions and the calculated central position;

10       evaluating each temporary viewpoint position based on each calculated distance; selecting a position where the viewpoint of the virtual camera should be moved among the temporary viewpoint positions based on the evaluation result;

moving the viewpoint position of the virtual camera to the selected position; and

perspective-transforming the three-dimensional space onto the virtual screen based upon the virtual camera where the viewpoint position is moved.

27. A carrier wave having a data signal of a game program for executing a video game that perspective-transforms a virtual three-dimensional space where multiple characters exist onto a virtual screen based upon a virtual camera having a viewpoint position moved in response to positions of the multiple characters, which is

20 superimposed thereon, wherein said game program causes a computer apparatus to execute:

moving at least one of the characters in the virtual three-dimensional space;

calculating a central position of the characters in the virtual three-dimensional space;

25       setting multiple temporary points in the virtual three-dimensional space with reference to the calculated central position;

setting a temporary viewpoint position on each straight line, connecting each of



the temporary points to the central position, where all of the characters can be projected on the virtual screen with a predetermined visual angle;

calculating a distance between each of the set temporary viewpoint positions and the calculated central position;

5 evaluating each temporary viewpoint position based on each calculated distance;

selecting a position where the viewpoint of the virtual camera should be moved among the temporary viewpoint positions based on the evaluation result;

moving the viewpoint position of the virtual camera to the selected position; and

perspective-transforming the three-dimensional space onto the virtual screen based

10 upon the virtual camera where the viewpoint position is moved.